



The Global Nuclear Energy Partnership (GNEP)

Integrated Spent Fuel Recycling Capability

The U.S. is moving from a once-through fuel cycle to a new approach that includes recycling of spent nuclear fuel without separating out pure plutonium. This capability would employ advanced technologies to increase proliferation resistance, recover and reuse fuel resources, and reduce the amount of wastes requiring permanent geological disposal at Yucca Mountain. This work builds on the Department of Energy's Advanced Fuel Cycle Initiative, which has been researching innovative recycle concepts since 2000.

Used nuclear fuel contains uranium, transuranic elements (plutonium and other long-lived radioactive material) and fission products. The fission products are waste and make up less than 5 percent of the used fuel. The buildup of the fission products inhibits the nuclear fission reaction, so used fuel must be removed from a nuclear power plant.

Under the Global Nuclear Energy Partnership (GNEP), recycling would comprise uranium extraction plus (UREX+) that would accomplish the following:

- Separate uranium from the spent fuel at a very high level of purification that would allow it to be recycled for re-enrichment, stored in an unshielded facility or simply buried as a low-level waste.
- Separate and immobilize long-lived fission products, technetium and iodine, for disposal in Yucca Mountain.

- Extract short-lived fission products, cesium and strontium, and prepare them for decay storage until they meet the requirements for disposal as low-level waste.

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High purity uranium oxide product recovered from used nuclear fuel using the UREX+ process



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- Separate transuranic elements (plutonium, neptunium, americium and curium) from the remaining fission products so they could be fabricated into fuel for an Advanced Burner Reactor, a fast reactor.

To consume, or destroy, transuranic elements while recovering their energy content, they must be separated from the uranium and fission products and then be fabricated into new fuel. Fast reactors would consume these transuronics, eliminating the need for their disposal in Yucca Mountain. This approach would potentially increase the effective capacity of the geologic repository by an estimated factor of 50 to 100.

Partnering with industry

The Department of Energy is investigating the interest and ability of

industry to deploy an integrated recycling capability consisting of two facilities:

- A Consolidated Fuel Treatment Center, capable of separating the usable components contained in light water spent fuel from the waste products.
- An advanced fast reactor, capable of consuming those usable products from the spent fuel while generating electricity.

U.S. national laboratories would design and direct a third component, the Advanced Fuel Cycle Facility, a modern state-of-the-art laboratory designed to serve fuels research needs for the next 50 years. It would use modular, flexible construction techniques with near-term priority given to the fabrication and qualification of fuels for an advanced fast reactor.

The U.S. will explore collaboration with fuel supplier nations on the development of these technologies.

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